

Remarks/Arguments

Applicant respectfully requests further examination and reconsideration in view of the above amendments and arguments set forth fully below. Claims 1-127 were previously pending in the present application. Within the Office Action, Claims 1-16, 18-26, 28-40, 45-59, 61-69, 71-83, 88-102, and 104-110 stand rejected, and Claims 17, 27, 41-44, 60, 70, 84-87, 103, and 124-127 are objected to. By way of the above amendments, Claims 1, 2, 12, 13, 28, 45, 88, 106, and 111 are amended. Accordingly, Claims 1-127 are currently pending in this application.

Rejections under 35 U.S.C. §102

Within the Office Action, Claims 1-7, 9, 11, 14, 45-50, 52, 54, 57, 88-94, 96, 98, and 100 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,269,372 to Chu et al. (Hereafter “Chu ‘372”). The Applicant respectfully traverses this rejection for the following reasons.

Chu ‘372 is directed to a cold plate 8 for cooling electronic modules and devices. The cold plate 8 includes a thermally conductive plate 10. The plate 10 is formed by milling an outer periphery leaving a thicker portion or pedestal 12 in the central region of one surface of the plate 10 (Chu ‘372, col. 3, lines 62-68). In other words, the plate 10 including the pedestal 12 form a single heat exchanging layer. The plate 10 includes an intersecting network of uniformly configured channels, called kerfs 14 and 16 (Chu ‘372, Figure 1: col. 2, lines 45-54). Cooling fluid is uniformly provided throughout the cold plate 10 by the kerfs 14 and 16. The fluid flows from the plate 10, through a seal plate 40, a manifold 50, and a top plate 70. Neither the seal plate 40, the manifold 50, nor the top plate 70 is a heat exchanging layer. Therefore, Chu ‘372 teaches only a single heat exchanging layer (plate 10). Chu ‘372 does not teach two distinct heat exchanging layers through which fluid flows and to which heat is passed.

The claimed invention is directed to two distinct heat exchanging layers. A first heat exchanging layer (Specification, Figure 18, element 604) is in contact with a heat source (Specification, Figure 18, element 99). The first heat exchanging layer comprises a thermally conductive material such that heat is passed from the heat source to the first heat exchanging layer. The first heat exchanging layer is configured so that fluid passes through the first heat exchanging layer to a second heat exchanging layer, also referred to as an intermediate layer or an interface layer (Specification, Figure 18, elements 602). Heat is passed from the first heat exchanging layer to the fluid as the fluid flows through the first heat exchanging layer.

A portion of the second heat exchanging layer is in contact with the first heat exchanging layer. The second heat exchanging layer comprises a thermally conductive material such that heat is passed from the first heat exchanging layer to the second heat exchanging layer. Heat from the second heat exchanging layer is passed to the fluid passing through the second heat exchanging layer. Configured in this manner, heat generated by the heat source is passed to the fluid during two stages. First, as the fluid passes through the first heat exchanging layer, and second as the fluid subsequently passes through the second heat exchanging layer. In this manner, heat is removed from the heat source to the first heat exchanging layer. Heat is passed from the first heat exchanging layer to the fluid passing therethrough and to the second heat exchanging layer in thermal contact with the first heat exchanging layer. Heat is also passed from the second heat exchanging layer to the fluid passing therethrough (Specification, page 45, line 24 to page 46, line 16). Chu '372 teaches a single heat exchanging layer through which fluid is passed, not two distinct heat exchanging layers through which fluid is passed. Further, Chu '372 teaches a single heat exchanging layer whereby heat is passed to the fluid. Chu '372 does not teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer.

The amended independent Claim 1 is directed to heat exchanger including a body having a conducting portion in contact with a heat source configured along a plane. The conducting portion conducts heat from the heat source to an intermediate conducting layer configured within the body. The conducting portion is configured to distribute fluid and to pass the distributed fluid therethrough to the intermediate conducting layer. The intermediate conducting layer is configured to pass the fluid therethrough. As discussed above, Chu '372 teaches a single heat exchanging layer where fluid is passed therethrough. Chu '372 does not teach two distinct heat exchanging layers where fluid is passed through each layer. For at least these reasons the independent Claim 1 is allowable over the teachings of Chu '372.

Because Claims 2-7, 9, 11, and 14 depend from allowable Claim 1, they are each also in a condition for allowance.

The amended independent Claim 45 is directed to a heat exchanger configured to cool a heat source configured along a plane. The heat exchanger includes an interface layer and a manifold layer. The interface layer has a thermal conductivity and is configured to pass fluid from a first side to a second side such that heat is passed from the interface layer to the fluid passing therethrough. The manifold layer includes a first layer and a second layer. The first layer is in contact with the heat source and is configured to pass fluid therethrough to the interface

layer. The first layer has an appropriate thermal conductivity to pass heat from the heat source to the fluid passing therethrough and to pass heat from the heat source to the first side of the interface layer. The second layer is coupled to the first layer and is in contact with the second side of the interface layer. As discussed above, Chu'372 teaches a single heat exchanging layer whereby heat is passed to the fluid. Chu '372 does not teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer. For at least these reasons the independent Claim 45 is allowable over the teachings of Chu '372.

Because Claims 46-50, 52, 54, and 57 depend from allowable Claim 45, they are each also in a condition for allowance.

The amended independent Claim 88 is directed to a method of manufacturing a heat exchanger configured to cool a heat source positioned along a plane. The method includes the step of providing a first layer configurable to be in contact with the heat source and to pass fluid along a heat conducting surface, wherein the first layer has an appropriate thermal conductivity to pass heat from the heat source to the fluid passing along the heat conducting surface. The method also includes the step of coupling a second layer having a thermal conductivity to the first layer, wherein a first side of the second layer is in contact with the heat conducting surface to receive heat therefrom and configured to pass fluid from the first layer therethrough such that heat is passed from the second layer to the fluid passing therethrough. As discussed above, Chu'372 teaches a single heat exchanging layer whereby heat is passed to the fluid. Chu '372 does not teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer. For at least these reasons the independent Claim 88 is allowable over the teachings of Chu '372.

Because Claims 89-94, 96, 98, and 100 depend from allowable Claim 88, they are each also in a condition for allowance.

Rejections under 35 U.S.C. §103

Within the Office Action, Claims 8, 10, 12, 15, 16, 18-23, 25, 26, 28-40, 45-59, 61-66, 68-69, 71-83, 88-102, 104-109, and 111-123 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chu '372 in view of U.S. Patent No. 5,388,6354 to Gruber et al. (hereinafter "Gruber"). The Applicant respectfully traverses this rejection for the following reasons.

Gruber is cited for teaching the use of at least one inlet and outlet port positioned substantially parallel with respect to the plane (where a heat exchanger is configured to cool a heat source). Gruber does not teach does not teach two distinct heat exchanging layers whereby

heat is passed to the fluid at each layer. As discussed above, Chu '372 teaches a single heat exchanging layer whereby heat is passed to the fluid. Chu '372 does not teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer. As such, neither, Chu '372, Gruber, nor their combination teach two distinct heat exchanging layers.

The amended independent Claim 45 is directed to a heat exchanger configured to cool a heat source configured along a plane. The heat exchanger includes an interface layer and a manifold layer. The interface layer has a thermal conductivity and is configured to pass fluid from a first side to a second side such that heat is passed from the interface layer to the fluid passing therethrough. The manifold layer includes a first layer and a second layer. The first layer is in contact with the heat source and is configured to pass fluid therethrough to the interface layer. The first layer has an appropriate thermal conductivity to pass heat from the heat source to the fluid passing therethrough and to pass heat from the heat source to the first side of the interface layer. The second layer is coupled to the first layer and is in contact with the second side of the interface layer. As discussed above, neither Chu '372, Gruber, nor their combination teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer. For at least these reasons the independent Claim 45 is allowable over the teachings of Chu '372, Gruber, and their combination.

Because Claims 46-59, 61-66, 68-69, and 71-83 depend from allowable Claim 45, they are each also in a condition for allowance.

The amended independent Claim 88 is directed to a method of manufacturing a heat exchanger configured to cool a heat source positioned along a plane. The method includes the step of providing a first layer configurable to be in contact with the heat source and to pass fluid along a heat conducting surface, wherein the first layer has an appropriate thermal conductivity to pass heat from the heat source to the fluid passing along the heat conducting surface. The method also includes the step of coupling a second layer having a thermal conductivity to the first layer, wherein a first side of the second layer is in contact with the heat conducting surface to receive heat therefrom and configured to pass fluid from the first layer therethrough such that heat is passed from the second layer to the fluid passing therethrough. As discussed above, neither Chu '372, Gruber, nor their combination teach two distinct heat exchanging layers whereby heat is passed to the fluid at each layer. For at least these reasons the independent Claim 88 is allowable over the teachings of Chu '372, Gruber, and their combination.

Because Claims 89-102, 104-109, and 111-123 depend from allowable Claim 88, they are each also in a condition for allowance.

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Claims 8, 10, 12, 15, 16, 18-23, 25, 26, and 28-40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over the teaching of Chu '372. Because Claims 8, 10, 12, 15, 16, 18-23, 25, 26, and 28-40 depend from allowable Claim 1, they are each also in a condition for allowance.

Within the Office Action, Claims 24, 67, and 110 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chu '372 in view Gruber and further in view of U.S. Patent No. 6,729,383 to Cannell. Claim 24 is dependent on the independent Claim 1. Claim 67 is dependent on the independent Claim 45. Claim 110 is dependent on the independent Claim 88. As discussed above, the independent Claims 1, 45, and 88 are each allowable. Because Claims 24, 67, and 110 depend from allowable base claims, they are each also in a condition for allowance.

The Applicant respectfully submits that the claims are in a condition for allowance, and allowance at an early date would be appreciated. Following the above amendment, Claims 1-169 are currently pending. Should the Examiner have any questions or comments, he or she is encouraged to call the undersigned at (408) 530-9700 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
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CERTIFICATE OF MAILING (37 CFR§ 1.8(a))

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